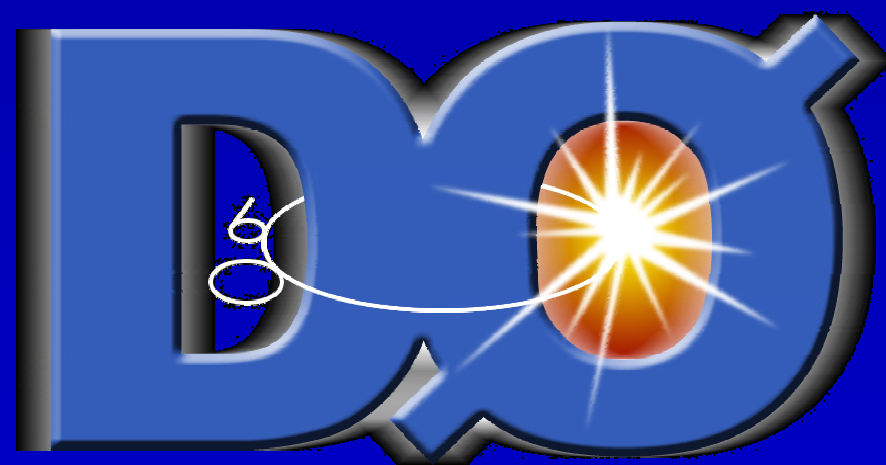
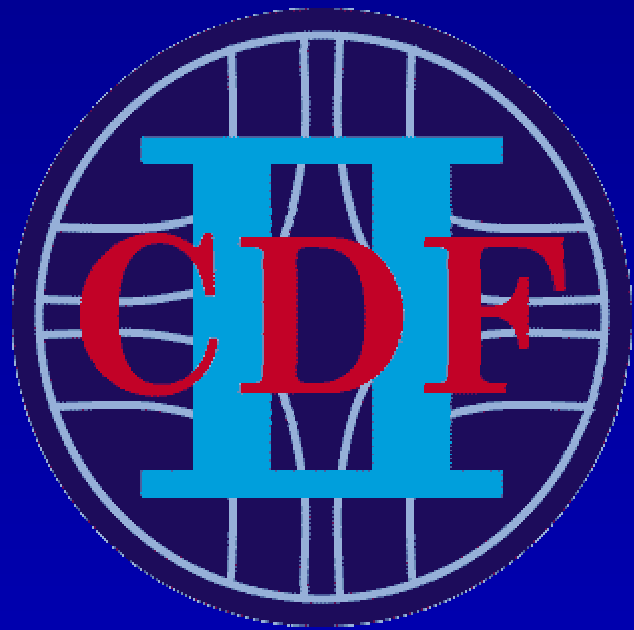


Fermilab Run II Database Requirements



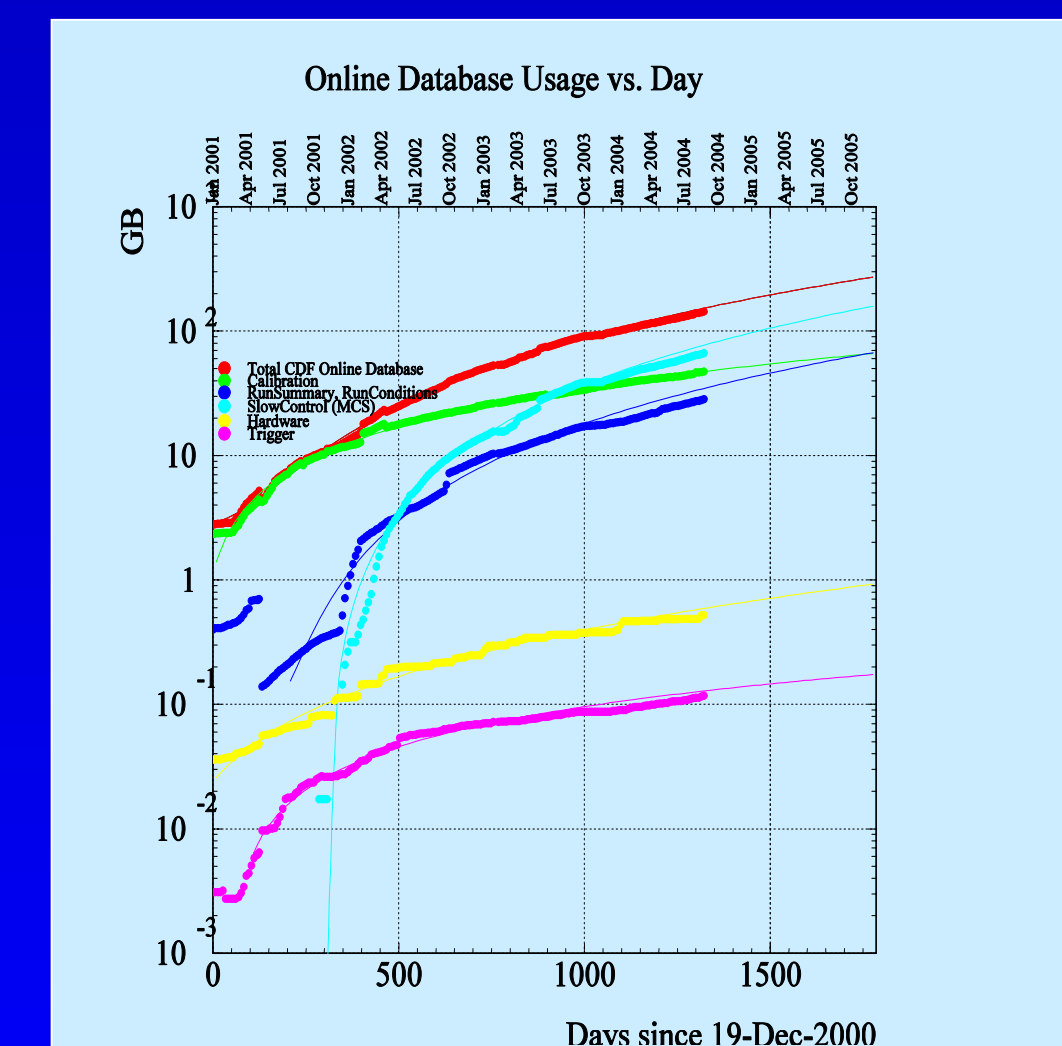
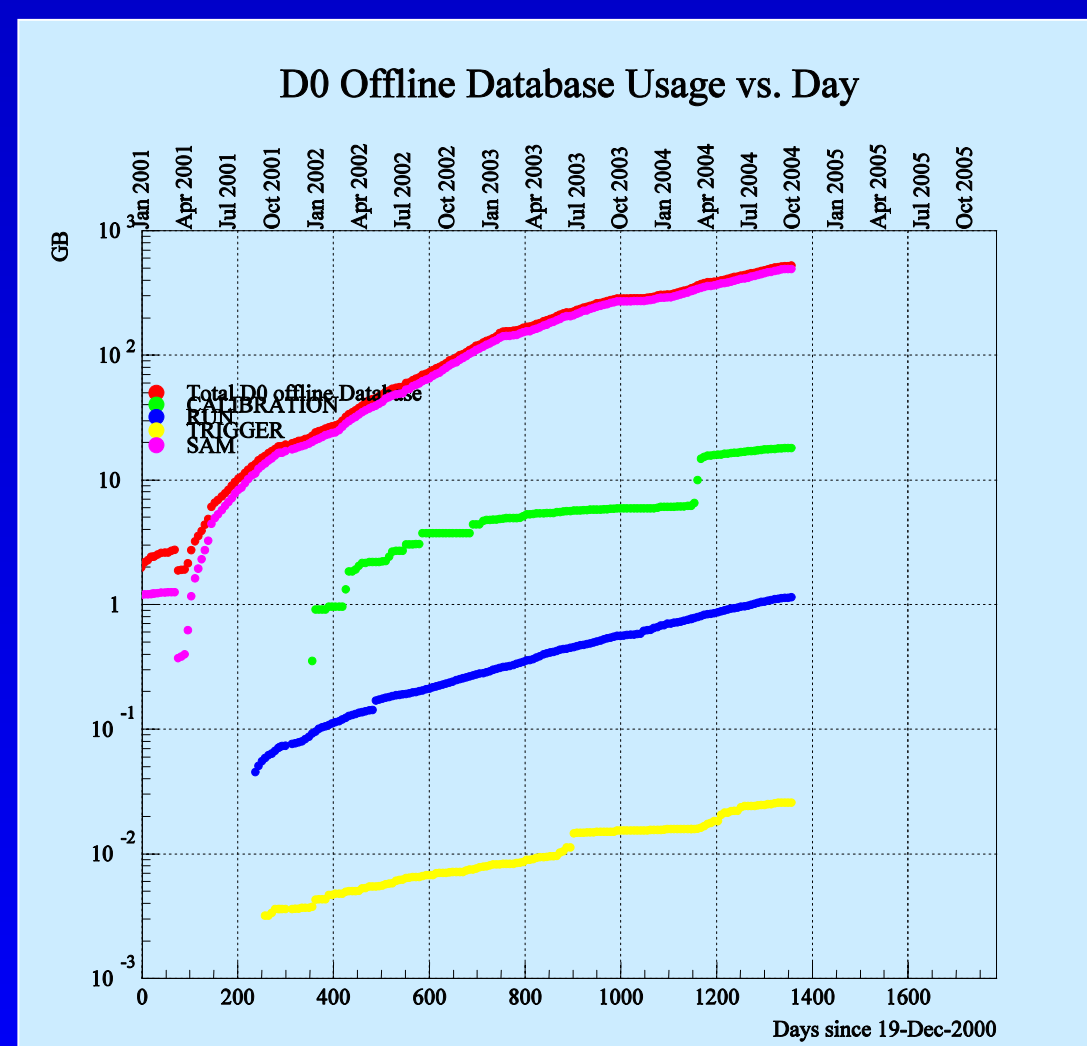
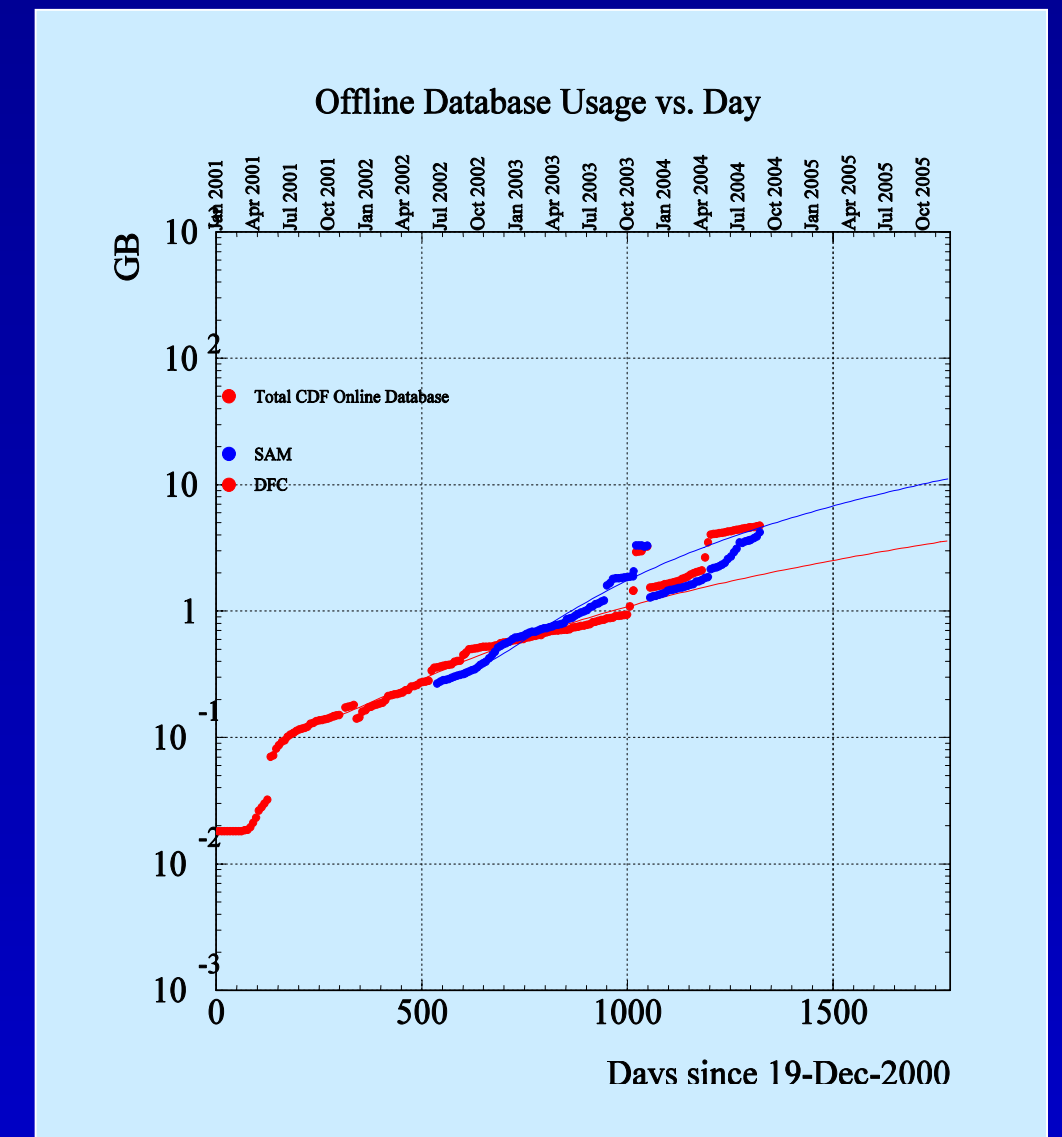
- Online databases are maintained at each experiment and are critical for data taking.
- Offline databases are maintained in the Feynman Computing Center and are critical for data processing and analysis.
- High Availability for both online and offline database systems is required.
- Database Applications Overview

- Detector and physics data
 - Detector Calibration
 - Trigger lists
 - Data Luminosity
 - Detector Slow Controls
 - Run and Run Quality information

– Data Handling (The SAM Database)

- Physics Metadata
- File catalog
- File replica management
- Processing information

- Database storage growth is shown in the accompanying charts (D0 left, CDF right).

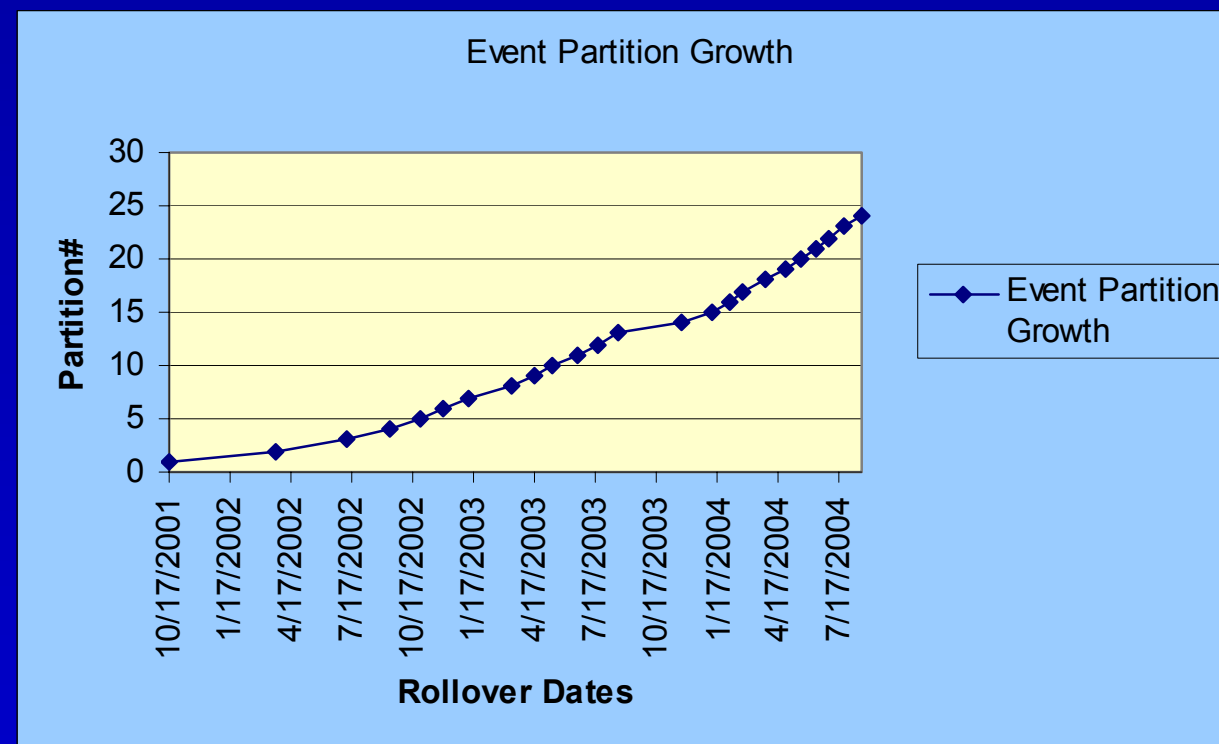


Fermilab Database Experience in Run II

Oracle in Run II

Table Partitioning

- Partitioning has been implemented for very large table(s) in the database.
- D0 uses a partitioned Events table with 50M events in each partition.
- Each partition is stored in its own tablespace and corresponding indexes are also partitioned and stored in their own tablespaces.
- Partitioning improves Query Optimization and Backup Performance
- Over 1 billion events are distributed over 24 partitions and a new partition is started about once a month.



Replication

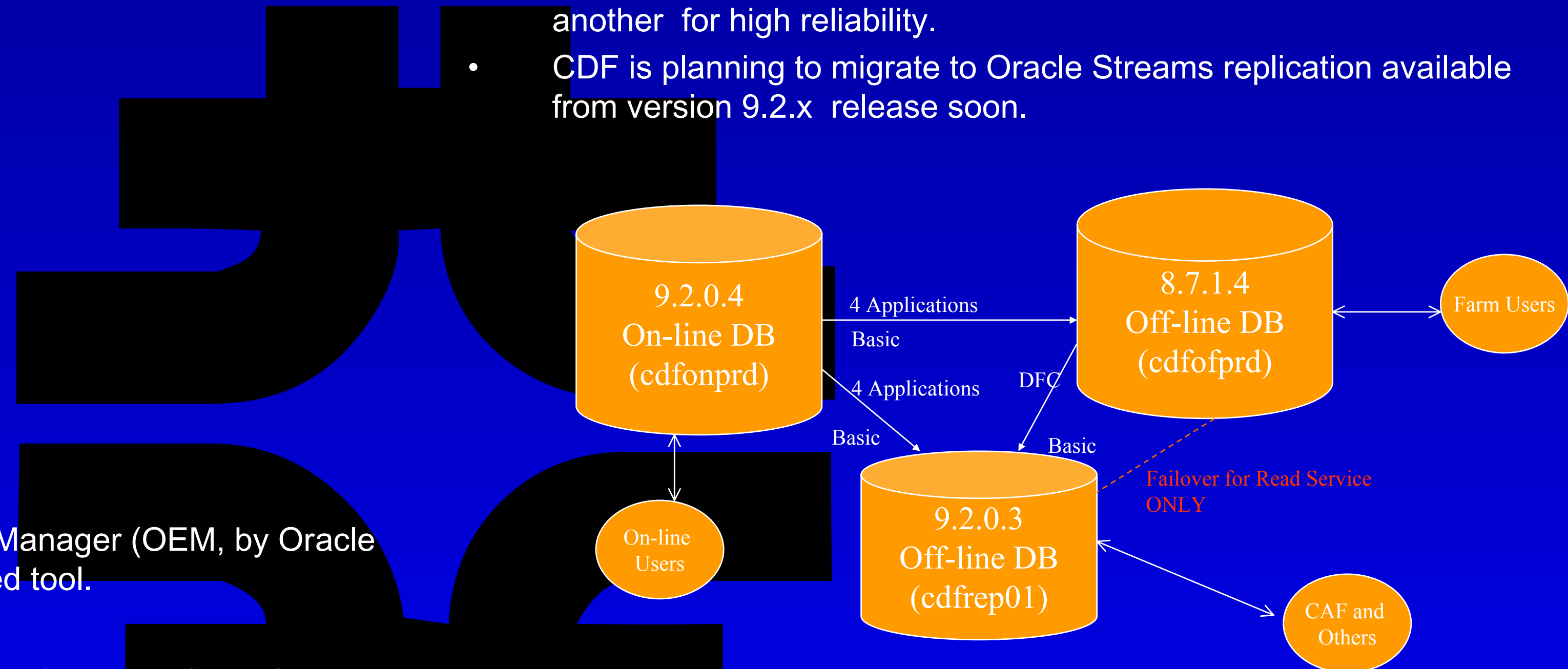
- Replication is used to share data in a large user.
- CDF has the same database structure for online and offline databases. Oracle's asynchronous replication is used to refresh offline tables from online tables periodically.
- One replica is used by Farm Users and the other is used by CAF and other READ ONLY users.
- A key feature of CDF replication is Fail-Over from one replica to another for high reliability.
- CDF is planning to migrate to Oracle Streams replication available from version 9.2.x release soon.

Data Base Monitoring:

- Monitoring is done using Oracle Enterprise Manager (OEM, by Oracle Corp) and TOOLMAN, an in-house developed tool.
- *OEM monitors the following:*
 - Node up and down, Database Listener down, Intelligent Agent
 - Number of storage extents and space usage
 - Database Alerts – Db down, file corruption
 - Number of concurrent sessions, CPU usage, Memory usage
 - Hit ratios for Library, Buffer Cache and other database resources.

• TOOLMAN

- Provides an alternative method to OEM for monitoring Oracle databases.
- Can be customized in several ways for the machine and databases it monitors.

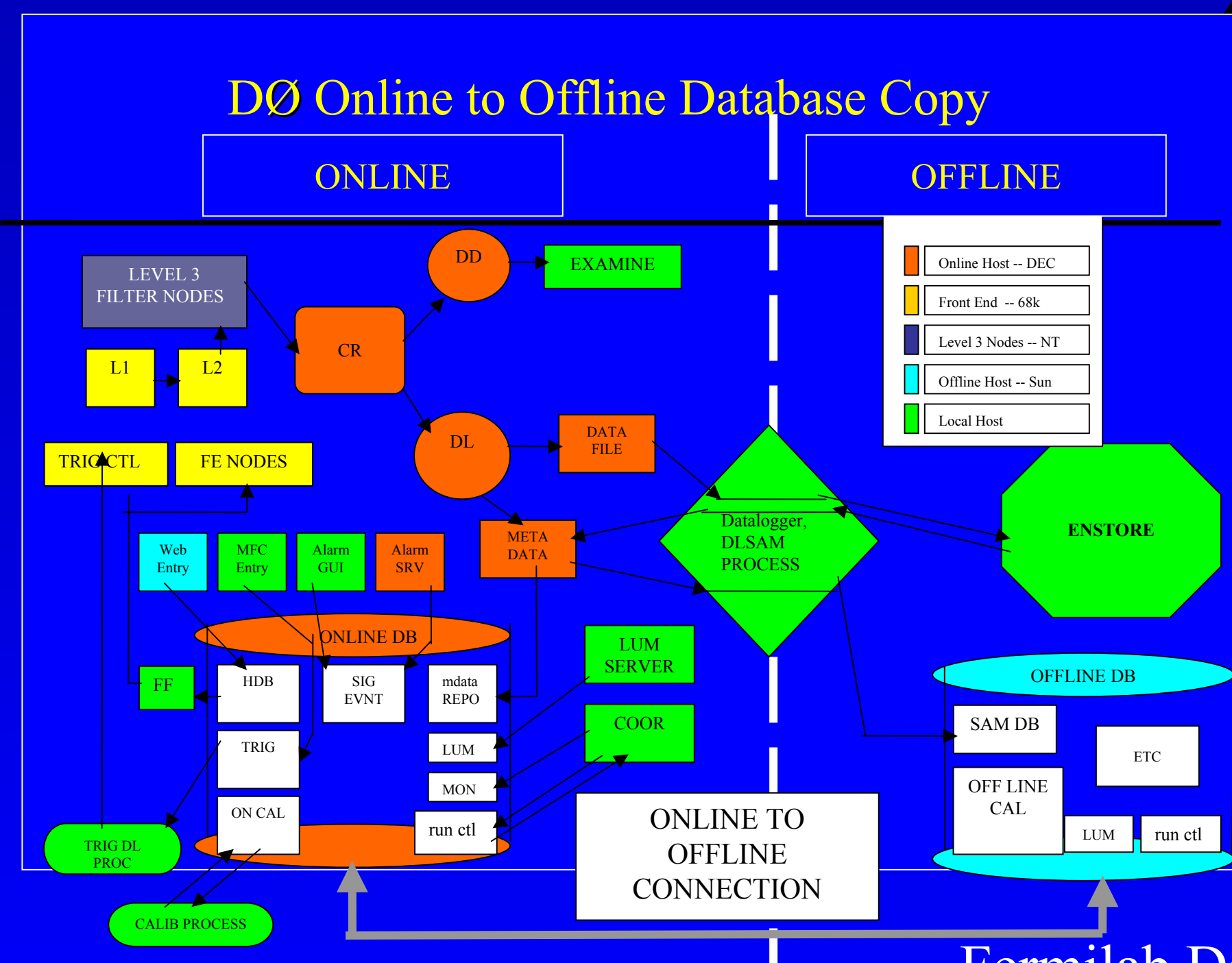
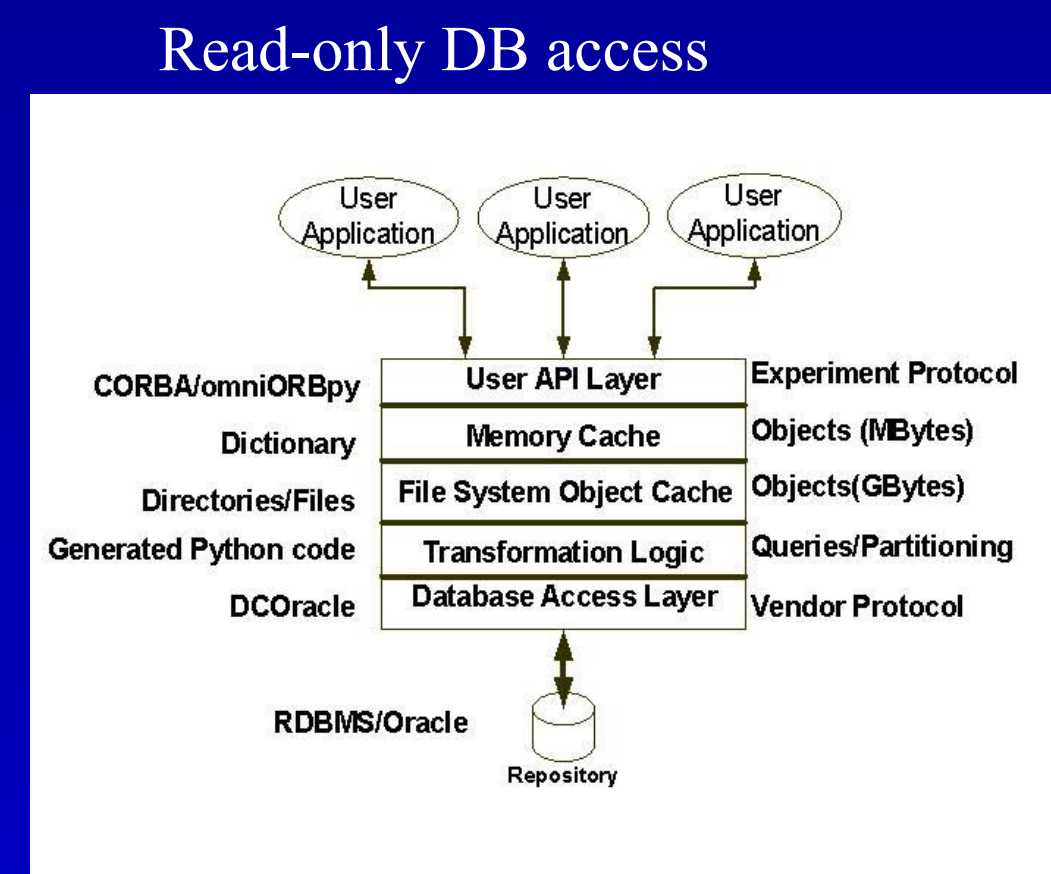


Run II Database Access

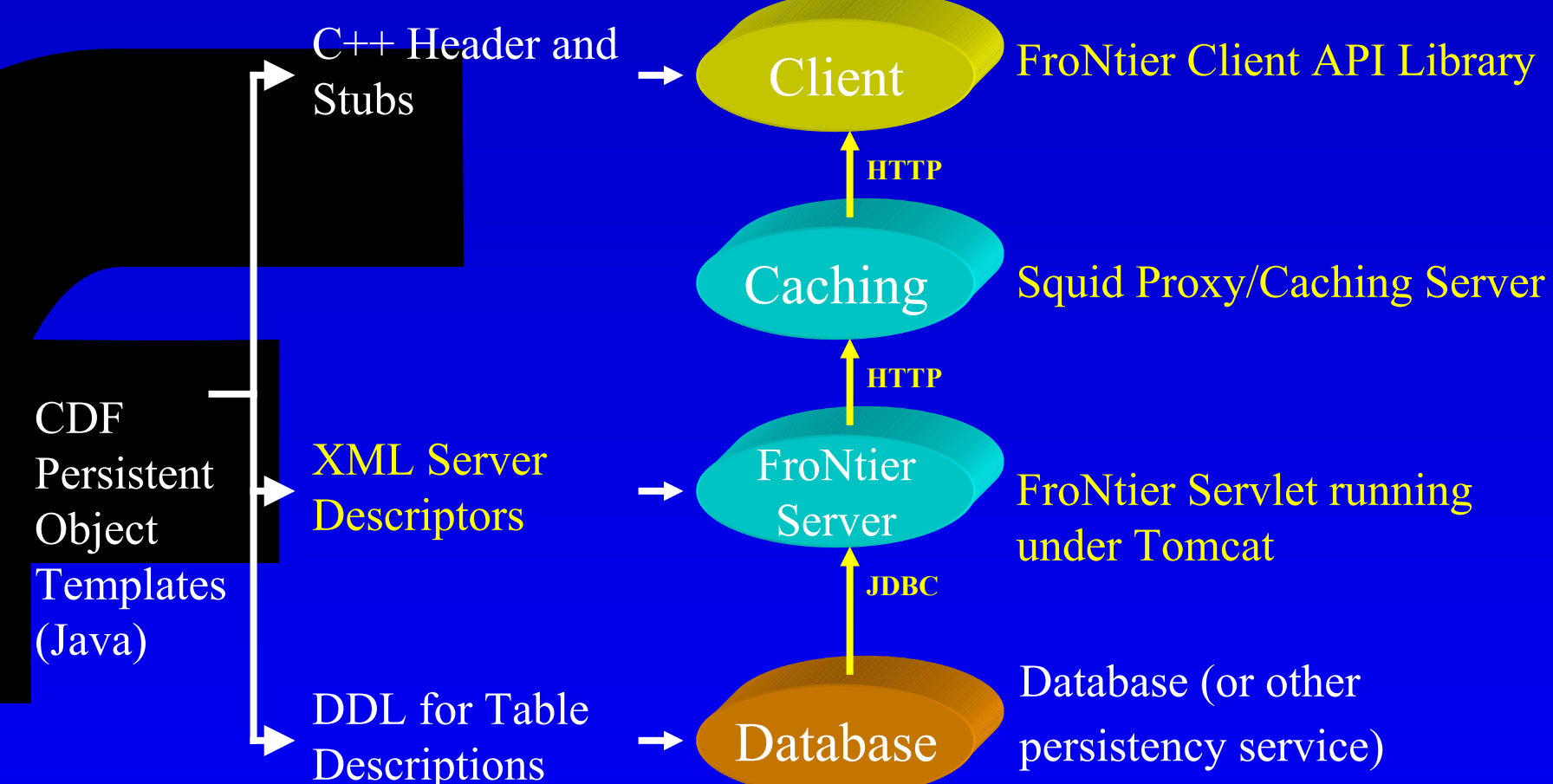
- For D0, only a subset of the online information was transferred to the offline database (Lower left).
- All access to the D0 offline database was through the Calibration DB server (DAN, upper right) or Data Handling server (SAM).
- CDF employed Basic Oracle replication to transfer all online database information to offline databases (See poster 'Oracle in Run II').
- FroNtier is a web-based, highly scalable, approach which is being developed for CDF to provide high performance database access to read-only information (Lower right).
<http://whcdf03.fnal.gov/ntier-wiki>

DØ Offline Caching Server: DAN (Database Access Network)

- CORBA interface to Client apps
- Memory (L1) and Disk (L2) caching
- Connection management to Database
- Server has common code base with SAM DB server



FroNtier Overview



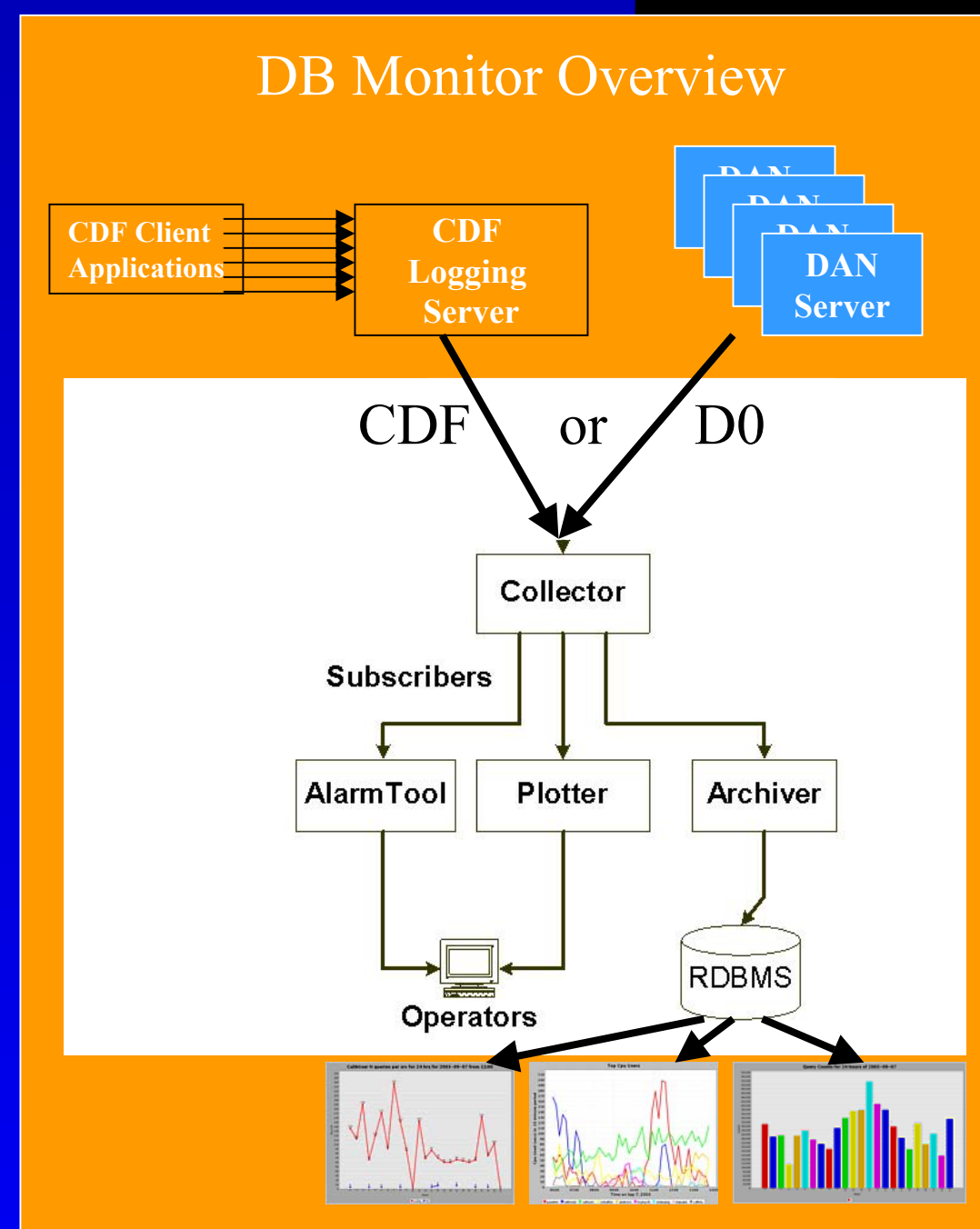
Fermilab Database Experience in Run II

Run II Database Performance and Monitoring

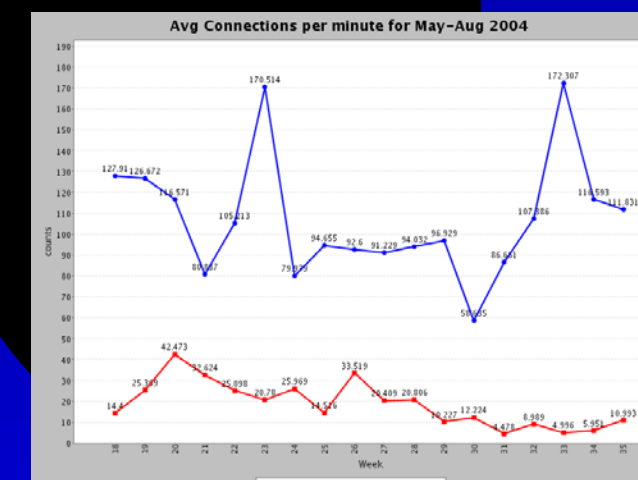
Database Monitoring is a crucial component of our Database Operation.

DBS Monitor

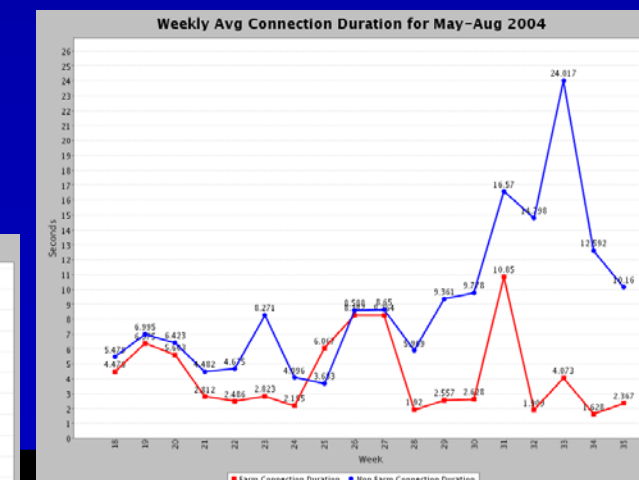
- DBS Monitor is used for collecting information on database access and presenting it through a web interface
- Project Goal: Common tools for Application Monitoring
- Information Generation is Experiment Specific
- The Collector gathers and parses data
- The Archiver uses a MySQL Repository
- Plotting tools use JavaFreeChart
- Histogramming uses JAIDA
- Admin and automation scripts are included.
- <http://dbsmon.fnal.gov>



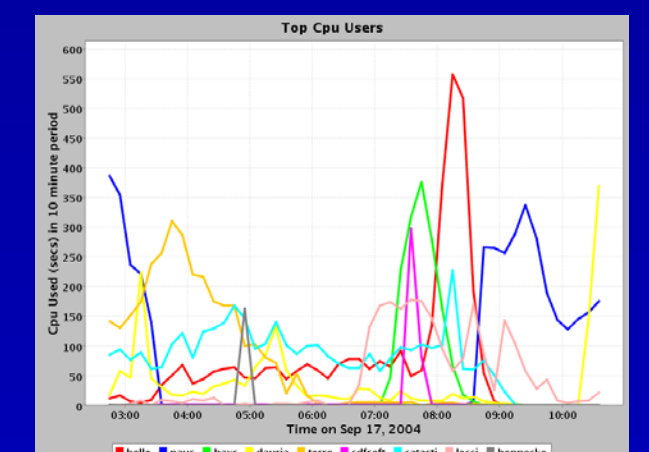
Number of connections per minute for CDF



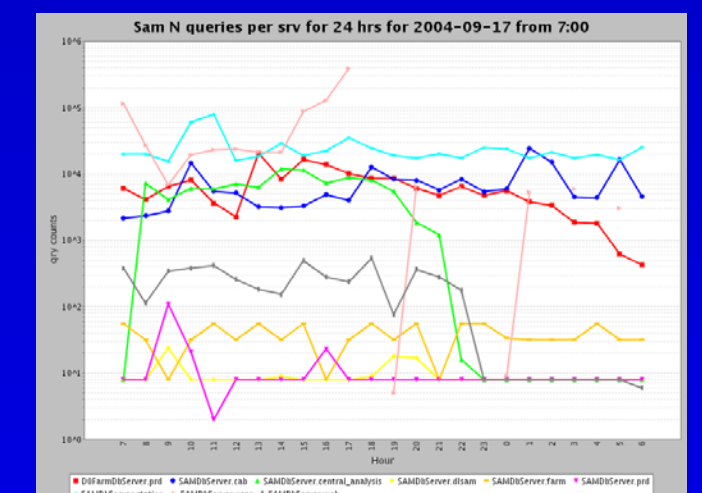
Average duration time for Database connections for CDF .



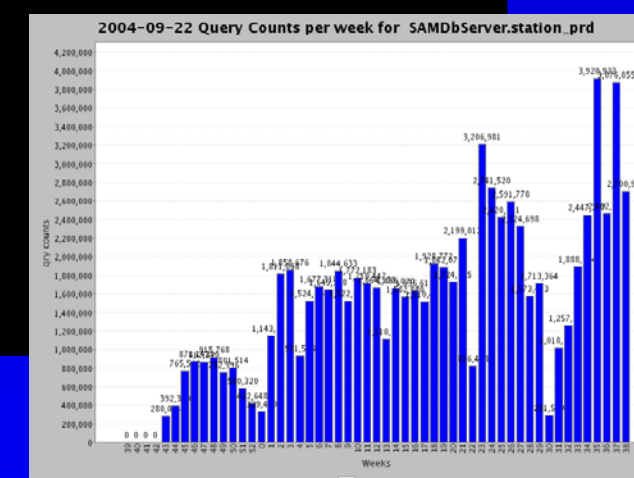
Top CPU users on CDF Database Applications over an 8 hour interval



D0 Sam Servers query counts over 24 hours interval



Query counts per week for D0 SAM station server



Number of queries per hour for D0 Farm and Non-Farm servers

